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Canadian Science Advisory Secretariat
Science Advisory Report 2006/047

HADDOCK ON THE SOUTHERN SCOTIAN SHELF AND IN THE BAY OF FUNDY (DIV. 4X/5Y)

Context

Haddock (Melanogrammus aeglefinus) are found on both sides of the North Atlantic. In the west Atlantic, they occur from southwest Greenland to Cape Hatteras. A major stock exists in the southern Scotian Shelf and Bay of Fundy area. This bottom-dwelling species is a member of the cod family and feeds mainly on small invertebrates. It is most common at depths of 25-125 fathoms (46-228m) and in bottom temperatures above 2°C. Although seasonal migrations are evident within the stock area, there is relatively little exchange between adjacent haddock stocks.

Haddock on the southern Scotian Shelf reach 15 inches (38 cm) and 1.1 pounds (0.5 kg) by age 4 on average. Growth slows thereafter and haddock reach only about 19 inches (48 cm) and 2.4 pounds (1.1 kg) by age 10. Haddock in the Bay of Fundy grow more rapidly than those on the southern Scotian Shelf. Approximately 50% of female haddock are mature by age 3; however the number of eggs produced by a female of this age is low and increases dramatically with age. Major spawning grounds are found on Browns Bank and peak spawning occurs in April/May.

Reported annual landings have been as high as 43,000t and the long-term average is about 18,000t. Landings have been below 11,000t since 1988. Historically this fishery has been dominated by mobile gear except during 1990-93 when the proportion of landings taken by fixed gear was greater. Quotas for this stock were introduced in 1970 and a spawning season/area closure has been in place since that time.

February 2007

Canada

SUMMARY

- Landings of 4X/5Y haddock in the fishing year ending March 31, 2006 were 5,141t relative to a quota of 8,000t. Following recommendation from industry, the quota in the 2006/07 fishing year was reduced to 7,000t.
- Spawning stock biomass (ages 4+) from the RV and ITQ surveys increased over the past decade and then decreased in last 2-3 years, but is still above the long-term average on Scotian Shelf. In the Bay of Fundy, spawning stock biomass is below the long-term average.
- Recent recruitment has been good; the 1998, 1999 and 2000 yearclasses are all strong, and the 2003 yearclass is moderate.
- Growth rate has decreased and size at age is small.
- The population is dominated by small fish, and small fish are being landed. There is no indication that discarding of small fish is occurring.
- The recruitment indices, age structure and relative F for the Scotian Shelf suggest that exploitation is low and allowing rebuilding of the age structure and abundance. On the other hand, these indicators suggest that exploitation in the Bay of Fundy may be too high and is hampering rebuilding and expansion of the age structure of the population in this area.
- There is no reason to change the advice from the previous assessment.

INTRODUCTION

Rationale for Assessment

Advice was requested by Fisheries and Aquaculture Management on the stock status of haddock in Div. 4X/5Y to inform the management of the 2007/08 fishery. Specifically:

- Evaluate whether the latest fisheries and research survey trends indicate any reason to change the advice for this stock for the 2007/08 fishery.

The Fishery

Landings* (000s t)

Year	1970-1979 avg.	1980-1989 avg.	1990-1999 avg.	2000-2001 avg.	2002	2003	2004	2005	2006
TAC	14.7	21.4	5.1	8.1	8.1	10.0	10.0	8.0	7.0
TOTAL	18.6	19.6	7.2	7.6	8.0	8.6	5.9	5.1	

* Commencing in 2000, fishing year, landings and TAC refer to the period April 1st of the current year to March 31st of the following year.

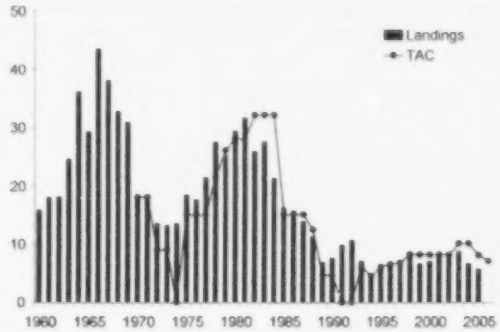

Figure 1. Landings and TACs ('000t) for 4X/5Y haddock.*

Landings of 4X/5Y haddock in the fishing year ending March 31, 2006 were 5,141t relative to a quota of 8,000t (Fig. 1). Following recommendation from industry, the quota in the 2006/07 fishing year was reduced to 7,000t. Landings for the current fishing year to November 3, 2006 were 2,968t, slightly less than last year for the same period.

The distribution of the fishery has changed in recent years, with an increasing proportion of haddock landings from 4Xmnop since 2003. Some of this increase has been a result of the winter fishery in 4Xn. Both the mobile gear and fixed gear sectors indicate that this is due primarily to the ability to direct for haddock with a minimal bycatch of cod. Some of the increase in the proportion of haddock caught in 4Xmnop is also due to increases in 4Xp, where vessels direct for larger haddock in deeper water. The proportion of haddock landings from 4Xp was 40% in 2005.

The proportion of small (<43cm) fish in the landings has increased over the last three years, and small haddock were prevalent again in 2006. However the high proportion of small fish being landed (based on port samples) and comparisons between port (shore) samples and observer (at-sea) samples indicates that highgrading small haddock is not occurring.

The catch at age for the stock does not show signs of a contraction of age range in the recent period.

ASSESSMENT

Stock Trends and Current Status

The research vessel (RV) and ITQ survey abundance indices at age (Fig. 2 and 3) indicate that **recruitment** is typically stronger on the Scotian Shelf than in the Bay of Fundy. Comparison of survey indices by area indicate that several yearclasses, 1998-2000, appear strong on the Scotian Shelf but only the 1998 yearclass appears strong in the Bay of Fundy. The 2006 survey updates now indicate that the 2003 yearclass is moderate on both the Scotian Shelf and in the Bay of Fundy.

RV and ITQ survey age composition for the Scotian Shelf displays an expanding age range in recent years while the age range for the Bay of Fundy has not expanded.

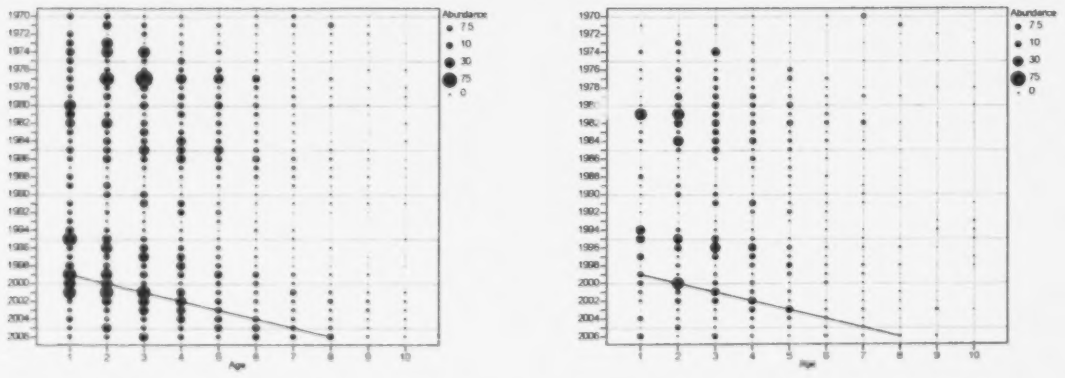

Figure 2. Age composition of RV survey indices by area (Scotian Shelf on left, Bay of Fundy on right) for 4X/5Y haddock. Solid line tracks 1998 yearclass.

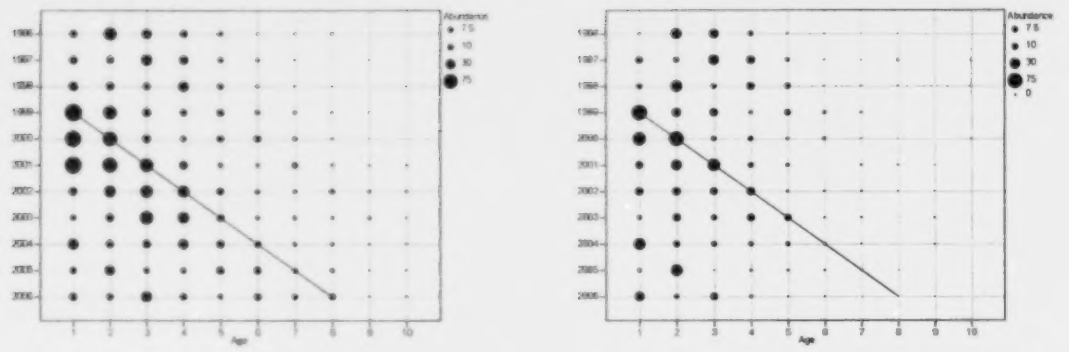

Figure 3. Age composition of ITQ survey indices by area (Scotian Shelf on left, Bay of Fundy on right) for 4X/5Y haddock. Solid line tracks 1998 yearclass.

Spawning stock biomass (ages 4+) from the RV surveys decreased from high levels in the late 1970s/early 1980s to low levels in the early 1990s. Spawning stock biomass increased to 2003 and has remained stable or decreased slightly in 2006 on the Scotian Shelf, but is above the long-term mean. Spawning stock biomass in the RV survey in the Bay of Fundy is half the long-term mean while is the lowest in the ITQ survey (Fig. 4).

The RV and ITQ surveys suggest that the proportion of spawning stock biomass in the Bay of Fundy is declining.

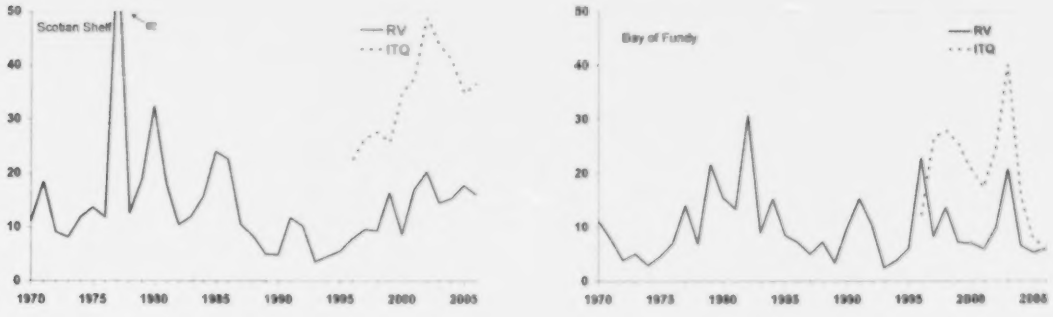

Figure 4. RV and ITQ survey 4+ biomass indices by area (Scotian Shelf on left, Bay of Fundy on right) for 4X/5Y haddock.

The 2005 assessment indicated **fishing mortality** has been below the F_{ref} since the mid-1990s. On the Scotian Shelf, relative fishing mortality has decreased since the early 1990s and suggests that exploitation is presently low, whereas it has been variable with no overall decline in the Bay of Fundy (Fig 5).

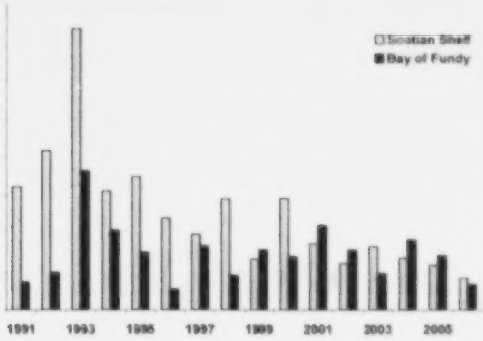

Figure 5. Relative fishing mortality by area in recent years for 4X/5Y haddock.

Consequently, the **length composition** of the RV survey abundance indicates that the population is dominated by small fish (<43cm) (Fig. 6). In 2006, 83% of haddock (by number) caught on the Scotian Shelf were <43cm, well above the long term mean, while 69% of the haddock caught in the Bay of Fundy were <43cm, also above the long term mean.

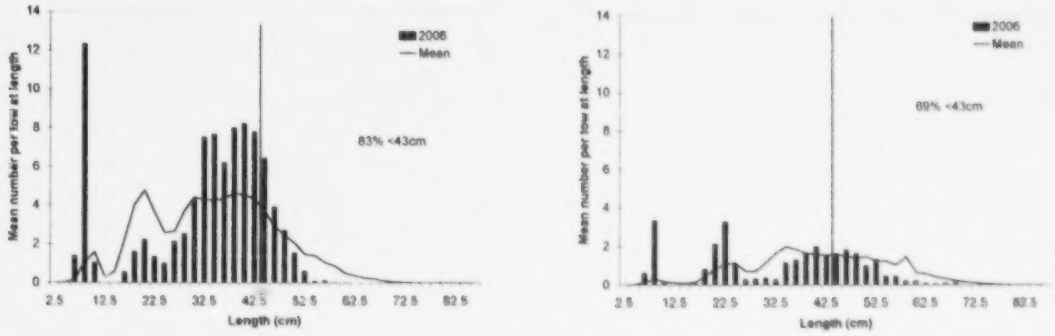

Figure 6. Length composition of 2006 RV survey catch (mean number per tow) compared to the long term mean (1970-2005). Vertical line indicates 43cm.

Mean lengths-at-age in the RV survey have been decreasing since the mid-1970s on the Scotian Shelf, particularly at older ages (Fig. 7). **Mean weights-at-age** show similar trends. Many ages are at or near the smallest size observed in the time series (Fig. 7). Although sizes-at-age are larger in the Bay of Fundy and the decreases are less extreme, older ages are also at or near the smallest sizes observed in 2006.

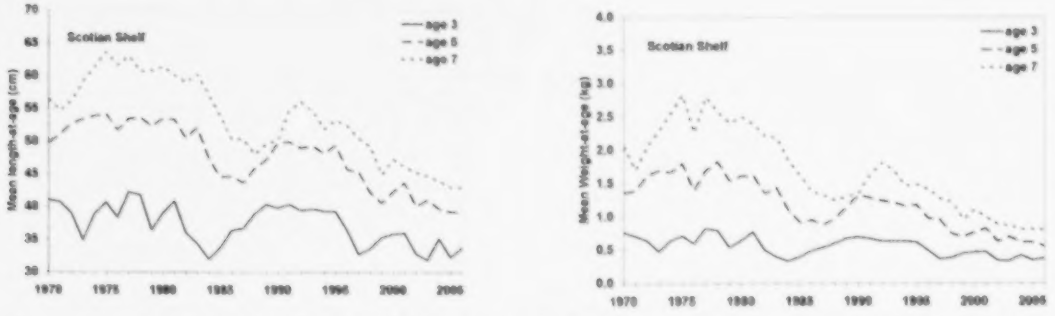

Figure 7. RV survey mean length-at-age (cm) (left) and mean weight-at-age (kg) (right) for 4X/5Y haddock.

An index of **fish condition**, predicted weight at 50cm calculated from the RV survey, has shown a decreasing trend since the early 1980s (Fig. 8). This index indicates that as well as getting smaller at age, fish are also getting "slinkier".

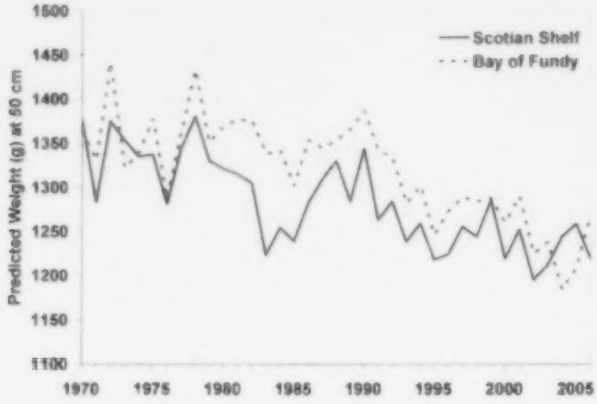

Figure 8. RV survey fish condition indices (predicted weight (g) at 50cm) by area for 4X/5Y haddock.

ADDITIONAL STAKEHOLDER PERSPECTIVES

Industry considers that the reasons the haddock quota in 4X5Y has not been caught in recent years are that haddock prices are low because the haddock are small, that fishing has been restricted because of the need to avoid cod and more recently pollock due to low quota allocation, that operating costs are high and fish prices in general are low, and that better catch rates and recent increases in the 5Z haddock quota have resulted in a shift in effort to 5Z.

There are a lot of small fish in the catch but these small fish are being landed. Industry agrees that highgrading of haddock is not occurring, and that there is little or no discarding or misreporting of haddock.

Concern was expressed in the decline in the weight-at-age.

Industry was generally in agreement with the haddock data presented by Science at the 2006 Data Input Meeting.

CONCLUSIONS AND ADVICE

Spawning stock biomass (ages 4+) from the RV and ITQ surveys has increased over the past decade and then decreased in last 2-3 years, but is still above the long-term average on Scotian Shelf. In the Bay of Fundy, spawning stock biomass is below the long-term average.

Recent recruitment has been good; the 1998, 1999 and 2000 yearclasses are all strong, and the 2003 yearclass is moderate.

Growth rate has decreased and size at age is small.

The population is dominated by small fish, and small fish are being landed. There is no indication that discarding of small fish is occurring.

The recruitment indices, age structure and relative F for the Scotian Shelf suggest that exploitation is low and allowing rebuilding of the age structure and abundance. On the other hand, these indicators suggest that exploitation in the Bay of Fundy may be too high and is hampering rebuilding and expansion of the age structure of the population in this area.

There is no reason to change the advice from the previous assessment.

OTHER CONSIDERATIONS

Cod and haddock are often caught together in groundfish fisheries, although their catchabilities differ and they are not necessarily caught in proportion to their relative abundance. With current fishing practices and cod/other species catch ratios, the achievement of rebuilding objectives for cod may constrain the harvesting of haddock. An imbalance in quotas creates potential for discarding and may require improved monitoring. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

The decline in growth and condition would be expected to result in poor recruitment. The long term implications of these on reproductive potential are a concern.

SOURCES OF INFORMATION

DFO, 2006. Proceedings of the Maritime Provinces Regional Advisory Process on Scotia-Fundy Groundfish Stocks; 16-17 Nov. 2006. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2006/035.

FOR MORE INFORMATION

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